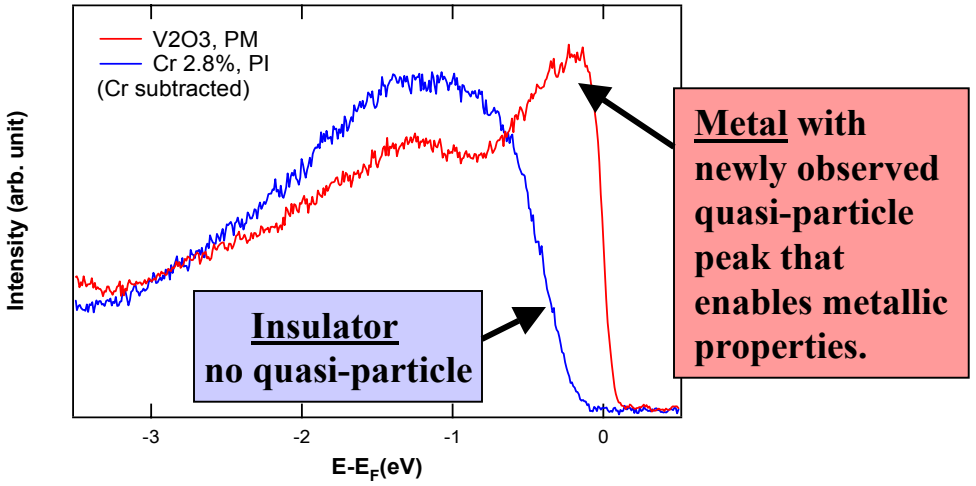
Metal-insulator transition in V_2O_3---New view of a famous old problem

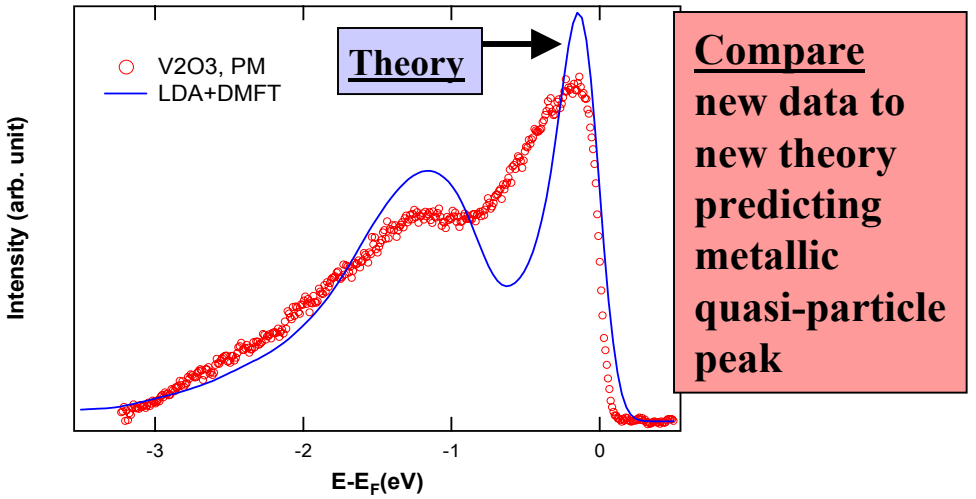
J.W. Allen, University of Michigan, DMR-0302825

The electrical behavior of materials is one of their most useful properties. Metals are good conductors of electricity and insulators are not.

Some materials switch abruptly from insulator to metal with changing temperature or applied pressure or alloying. Understanding this spectacular transition is an old and baffling problem of materials physics. The alloy system $(V_{1-x}R_x)_2O_3$ (R=Cr,Ti) is the most intensely studied material system, thought to be a paradigm for an elegant theoretical idea called the "Mott transition."

Using a technique called photoemission spectroscopy we measure the energy distribution of electrons in this system and compare the result to predictions from a new theory of the Mott transition. This theory links two powerful methods called "dynamic mean field theory" and "density functional theory," and predicts the prominent metal "quasi-particle" that we have observed for the first time.





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International Collaboration:
This work** is an international collaboration that builds bridges between researchers in five countries.

Members of our Michigan group performed the photoemission experiments with researchers from Pohang, Korea and Osaka, Japan at Japan's SPring-8 synchrotron, using samples prepared at Purdue University.

The theoretical "DMFT + LDA" calculations were performed by a team of researchers in Augsburg, Germany and Ekaterinburg, Russia.

Education:
This grant provides partial support for two graduate students, Sung-Kwan Mo and Feng Wang. Both have passed their Ph.D. candidacy exams.

Bird's eye view of Japan's SPring-8 Synchrotron sited at Harima Science Garden City

**** publication with author list:**
S.-K. Mo et al,
Physical Review Letters 90, 186403 (2003).